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> # Prof. Dr. Serkan Dağ
  # ME 310 Numerical Methods
  # File 3.2
  # Bisection method
  # Solves the nonlinear equation of the form f(x)=0
> restart :
  Digits := 16 :
> # Define the equation
> f := sin(x) − x²;
```

$$f := \sin(x) - x^2 \tag{1}$$

```
> # Specify xl and xu
> xl := 0.8 :
  xu := 1.0 :
> # Define maximum number of iterations
> kmax := 20 :
> # Number of significant figures and error criterion
> n := 3 :
  epss := 0.5·10^{2 − n};
```

$$epss := 0.05000000000000000 \tag{2}$$

```
> xro := (xl + xu)/2 :
```

```
> # Initiate the iterations
> for k from 1 by 1 to kmax
  while true do
   if k = 1 then
   printf("\n %5.1f %15.10f %15.10f %15.10f", k, xl, xu, xro);
   end if:
  fxl := subs(x = xl, f) :
  fxr := subs(x = xro, f) :
   if fxr = 0 then
   epsa := 0 :
  xrn := xro :
  printf("\n %5.1f %15.10f %15.10f %15.10f %15.10f", k, xl, xu, xrn, epsa);
   break:
   elif fxl·fxr < 0 then
  xu := xro :
   elif fxl·fxr > 0 then
  xl := xro :
   end if:
  xrn := (xl + xu)/2 :
   if xrn ≠ 0 then
  epsa := abs((xrn − xro)/xrn)·100 :
   end if:
   printf("\n %5.1f %15.10f %15.10f %15.10f %15.10f", k + 1, xl, xu, xrn, epsa);
   if epsa < epss then
   break:
   end if:
  xro := xrn :
```

end do:

```
1.0      0.8000000000     1.0000000000     0.9000000000
2.0      0.8000000000     0.9000000000     0.8500000000     5.8823529412
3.0      0.8500000000     0.9000000000     0.8750000000     2.8571428571
4.0      0.8750000000     0.9000000000     0.8875000000     1.4084507042
5.0      0.8750000000     0.8875000000     0.8812500000     0.7092198582
6.0      0.8750000000     0.8812500000     0.8781250000     0.3558718861
7.0      0.8750000000     0.8781250000     0.8765625000     0.1782531194
8.0      0.8765625000     0.8781250000     0.8773437500     0.0890471950
9.0      0.8765625000     0.8773437500     0.8769531250     0.0445434298
```

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